Underexposure display
or
Incorrect exposure display
or
Incorrect exposure early warning system

There are different reasons for the incorrect exposure display to come up:

1) An exposure has not been terminated as provided

1.1 during non-automatic exposures (normally terminated by **mA-control**)
- due to an exposure hand switch which has been released too early
- due to an interrupted exposure command of the system

1.2 during automatic exposures (normally terminated by **dose rate control**)
- due to an exposure hand switch which has been released too early
- due to an interrupted exposure command of the system

1.3 during automatic exposures prematurely terminated by the **AEC fault exposure detection**

1.4 due to a setting / system malfunction during **TDC** exposures

1.5 as one of the max limits have been reached (mAs or ms limit), see Appendix A

2) An error occurred which interrupted the exposure.

What happens with the data display on the control desk?

Exposure parameters of **non-automatic** exposures
kV-mAs **kV-mAs-ms** **kV-mA-ms**
remain in the control desk display as set.

The post-indication values of interrupted **AEC** (**automatic exposure control)** exposures
kV falling load (kV) **kV fixed current (kV-mA)** **tomo density control (TDC)**
remain on the display for 25 seconds, afterwards the set exposure values re-appear.

One can see the post indication values again after pushing the key once, but one has to turn the flashing under exposure light first.

To figure out why the underexposure display is flashing one has to push the

key.

If the underexposure display goes out after pushing the

key once one has to look for one of the reasons given at **1)**.
None of the reasons given at **1)** lead to an error entry in the error log index, details to **1.x** items next page.

If the

key has to be pushed twice to get the underexposure display off an error event (case **2)**) interrupted the exposure.

The first

key stroke erases the error condition, the second one turns the underexposure display off.

Sometimes the error display disappears from the display, but one can see the error again after pushing the key three times in a row.
If there is more than one error logged for the same event only the last one is displayed at the desk.
Check the error log index and look for individual or multiple entries.
Multiple entries are typically logged almost at the same time or with just one or a few seconds difference.
Check the error details afterwards and solve the problems.

Detailed explanation of exposure terminations leading to a flashing underexposure display:

1.1 Optimus generators terminate the **non-automatic** exposures once the set mAs value has been achieved no matter which of the non-automatic techniques has been selected.
Function unit mA control EZ119 then sends the exposure off command.

> There must have been an external interrupt of the exposure command signal, e.g. let go of the exposure hand switch.

> There must have been an interrupt of the system exposure command signal, e.g. the grid or or tomo sweep contact.

> If FU mA does not terminate Central Unit EZ139 will finally do with a backup timer, but then there will be an error code additionally to the flashing under exposure display.

1.2 If **dose rate control** does not terminate an **AEC exposure**

> There must have been an external interrupt of the exposure command signal, e.g. let go of the exposure hand switch.

> There must have been an interrupt of the system exposure command signal, e.g. the grid or or tomo sweep contact.

1.3 The **AEC fault exposure detection** terminates exposures if the dose signal coming in did not increase a certain level which is calculated from the cassette speed and other APR parameters. Detailed explanations in Optimus service manuals chapter FAULT FINDING.

> Malfunction of the measuring chamber or the cable connection to the generator back panel.

> APR settings (kV, cassette speed) and patient size don’t not match.

1.4 Identical functionality to 1.3, just for tomo with one exception:

> Attenuation of object too small. 0.5mAs and 1mA are smallest values. Once lower values are requested by dose rate control the under exposure signal flashes.

1.5 See Appendix A.

Appendix A

Optimus limit values

> Program
> Application Limits

X-Mode Limits

Limit values can be defined for all available techniques. Some values look as if they are out of limit which they are indeed, but there are additional basic limit values programmed in the generator firmware. These are exposure technique dependent.

As an example the field of the "Falling Load" technique:

X-ray Mode:	AEC falling load kV
Min. Time Limit [ms]:	[1.00]
Max. Time Limit [ms]:	[60000.00]
Min. Current Time Product Limit [mAs]:	[0.001]
Max. Current Time Product Limit [mAs]:	[580.000]

Min. Time Limit [ms]: Is always 1ms for all non-AEC (Automatic Exposure Control) techniques. Exposures with AEC might be switched shorter than 1ms.

Max. Time Limit [ms]: Basic limits are technique dependent and can not be changed or increased:

AEC falling load		kV	4000ms
AEC fixed current		kV-mA	4000ms
TDC (tomo density control)			6000ms
	/	kV-mA-ms	16000ms
free techniques	‹	kV-mAs	16000ms
	\	kV-mAs-ms	16000ms

Min. Current Time Product Limit [mAs]: The smallest mAs - product is 0.5mAs.
AEC exposures with less than 0.5mAs are possible.

Max. Current Time Product Limit [mAs]: The default mAs - product is 580mAs for all AEC-techniques. 850mAs is the absolute limit at which the generator in always terminates.
!! Local limits have to be taken into consideration.

Thoravision Limits

There are default mAs-limits programmed to prevent over-saturation of and memory effects on the selenium drum.
These limits should only be modified by the local application according to the typical average patient size.